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PEDAGOGICAL BASIS OF PREPARING FUTURE MATHEMATICS TEACHERS FOR SCIENTIFIC AND RESEARCH ACTIVITIES IN AN ELECTRONIC INFORMATION-EDUCATIONAL ENVIRONMENT

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Abstract
This article covers the scientific and theoretical aspects of the pedagogical foundations of preparing future mathematics teachers for scientific and research activities in an electronic information-educational environment. The article analyzes the content and essence of the concepts of "electronic information-educational environment", "scientific and research activities" and "preparation", and the information-resource, instrumental-technological, communicative-collaborative and control-diagnostic functions of the electronic information-educational environment are based. Also, pedagogical conditions ensuring the effectiveness of this process are identified.

Keywords: Electronic information and educational environment, scientific and research activities, pedagogical conditions, professional training, digital educational technologies.

Introduction

ELEKTRON AXBOROT-TA’LIM MUHITIDA BO‘LAJAK MATEMATIKA O‘QITUVCHILARINI ILMIY-TADQIQOT FAOLIYATIGA TAYYORLASHNING PEDAGOGIK ASOSLARI

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Annotatsiya
Ushbu maqolada elektron axborot-ta'lim muhitida bo'lajak matematika o'qituvchilarini ilmiy-tadqiqot faoliyatiga tayyorlashning pedagogik asoslari ilmiy-nazariy jihatdan yoritilgan. Maqolada "elektron axborot-ta'lim muhiti", "ilmiy-

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tadqiqot faoliyati" va "tayyorgarlik" tushunchalarining mazmun-mohiyati tahlil qilingan, elektron axborot-ta'lim muhitining axborot-manbaviy, instrumental-texnologik, kommunikativ-hamkorlik hamda nazorat-diagnostik funksiyalari asoslangan. Shuningdek, ushbu jarayonning samaradorligini ta'minlovchi pedagogik shart-sharoitlar aniqlangan.

Kalit so'zlar: elektron axborot-ta'lim muhiti, ilmiy-tadqiqot faoliyati, pedagogik shart-sharoitlar, kasbiy tayyorgarlik, raqamli ta'lim texnologiyalari,

Introduction

The deepening of digitalization processes in the modern education system, the development of electronic information and educational environments (EATM), and changes in the methods of creating and distributing scientific knowledge pose new challenges for pedagogical higher education institutions. In the professional formation of a future mathematics teacher, it is important that he has the competence not only to teach a subject, but also to conduct independent scientific research activities. This, in turn, requires the scientific substantiation of the pedagogical foundations of the development of research skills using the didactic potential of EATM.

In the future, a future mathematics teacher should act not only as a transmitter of ready-made knowledge, but also as a person who forms a culture of mathematical thinking, problem research and proof in students. To successfully fulfill such a task, the teacher himself must master the methodology of scientific research activities. At the same time, in the traditional training system, the formation of research competence is often carried out not as a separate discipline, but as part of the graduation qualification work, in a short-term and intermittent manner. The electronic information and educational environment allows this process to be organized in a consistent, individualized and resource-rich manner.

In the context of the digital transformation of the modern higher education system, the concepts of electronic information and educational environment, research activity and training are recognized as important pedagogical categories for the professional formation of future mathematics teachers. A scientific and theoretical analysis of the content and essence of these concepts allows us to reveal their interrelationships and identify mechanisms for developing research competence of future specialists.

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Literature review

The electronic information and educational environment is currently interpreted as an integrated pedagogical system that provides organization, management and monitoring of the educational process based on information and communication technologies. This environment involves the harmonious operation of software and hardware tools, e-learning platforms, digital educational resources, scientific databases, virtual laboratories, cloud technologies, and online communication tools in a single information space. This environment expands the opportunities for students to independently learn, search, process, analyze, and effectively use scientific information.

From the point of view of mathematics education, the electronic information and educational environment is of particular importance. Because it is difficult to fully organize the acquisition of mathematical knowledge and the implementation of scientific research without modern digital tools. In particular, mathematical programs such as GeoGebra, MATLAB, Wolfram Alpha, Desmos allow you to perform complex calculations, create mathematical models, visualize functions, and analyze experimental results. Also, educational platforms such as Moodle, Google Classroom, Microsoft Teams create a convenient pedagogical environment for managing educational materials, organizing scientific assignments, establishing remote collaboration, and monitoring students' scientific activities. As a result, the electronic information and educational environment is not only a teaching tool, but also an innovative educational space that supports scientific research activities.

Scientific research activity is a consistent and purposeful type of intellectual and practical activity aimed at creating new scientific knowledge, and includes such stages as identifying a problem, defining the purpose of the research, putting forward a scientific hypothesis, collecting theoretical and empirical data, analyzing them using mathematical and statistical methods, summarizing the results obtained and presenting them to the scientific community. This activity is an important factor in the formation of the future mathematics teacher's analytical thinking, scientific thinking, drawing logical conclusions and the competence to apply innovative approaches.

Research Methodology

The scientific and research activity of a future mathematics teacher is manifested as the integration of two main areas. The first area is related to mathematical research,

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in which the main place is occupied by the development of strategies for solving mathematical problems, the creation of mathematical models, the improvement of methods for proving theorems, and the analysis of computational algorithms. The second direction covers pedagogical research and includes scientific research aimed at improving mathematics teaching methods, determining the effectiveness of innovative pedagogical technologies, assessing the didactic potential of digital educational tools, and developing students' mathematical competencies. The combination of these two directions serves to enhance the professional and scientific potential of the future teacher.

As a pedagogical category, preparation is described as a holistic system of theoretical knowledge, practical skills, professional qualifications, motivational and value orientations, and reflexive abilities necessary for a person to successfully carry out a certain activity. Preparation for scientific and research activities embodies the student's competence to independently identify a scientific problem, effectively use modern electronic information resources, consciously apply scientific methods, scientifically substantiate research results, and formalize them in accordance with the requirements of academic ethics.

The electronic information and educational environment plays an important role in the preparation of future mathematics teachers for scientific and research activities not only as a means of information exchange, but also as an innovative didactic space serving to form research competence. This environment expands the opportunities for students to develop scientific thinking, conduct independent research, solve scientific problems based on modern digital technologies, and present research results to the scientific community. The didactic potential of the electronic information and educational environment is manifested through its functional capabilities.

The electronic information and educational environment performs an information-resource function. This function serves to provide students with modern scientific information resources, develop skills in searching, sorting and analyzing scientific literature. Through the use of scientific databases such as electronic libraries, open scientific journals (Open Access), preprint platforms (arXiv, SSRN), Google Scholar, Scopus and Web of Science, a culture of working with scientific information is formed in students. In particular, regular work with scientific articles, monographs and methodological studies in the field of mathematics serves to broaden the scientific worldview and develop critical thinking. One of the important aspects of the

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electronic information and educational environment is its instrumental and technological function. Modern mathematical programs and computing systems are becoming an integral part of the research process. In particular, GeoGebra, MATLAB, Wolfram Mathematica, Wolfram Alpha, Desmos, Python and the R programming environment allow for mathematical modeling, testing algorithms, statistical analysis, visualization of experimental results and verification of their reliability. Effective use of these tools will integrate the research activities of future mathematics teachers with modern technologies and build their digital research competencies.

The electronic information and educational environment also serves to develop scientific cooperation through its communicative and collaborative function. With the help of digital platforms, students have the opportunity to communicate remotely with scientific supervisors, professors and teachers and peers, participate in virtual seminars, webinars, conferences and scientific projects. Such cooperation serves to exchange scientific ideas, discuss research results, receive constructive feedback and develop a culture of scientific communication.

Another important aspect of the electronic information and educational environment is related to its control and diagnostic function. Using electronic portfolios, Learning Analytics technologies and automated monitoring systems, all stages of students' scientific and research activities are regularly monitored. The processes of choosing a research topic, collecting and analyzing data, preparing a scientific article and presenting results are evaluated through electronic monitoring. This, while ensuring transparency and objectivity of the assessment, allows you to determine the dynamics of the student's individual development and provide the necessary pedagogical support in a timely manner.

Analysis and results

The process of preparing future mathematics teachers for scientific and research activities in the electronic information and educational environment should be organized based on scientifically based pedagogical principles. These principles serve to systematically harmonize the content, methods and technologies of the educational process.

First of all, the principle of consistency and gradualness implies the organization of the preparatory process on the basis of a logical sequence. In this case, the student's scientific activity begins with a motivational-orientational stage and is gradually

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developed through theoretical and methodological preparation, practical research activities and reflective assessment stages. Each stage serves as a methodological basis for the next one.

The principle of interdisciplinary integration ensures the interdependence of the disciplines of mathematics, pedagogy, information technology, statistics and scientific research methodology. This integration allows the student to analyze complex scientific problems from the perspective of different disciplines and develop complex solutions.

The flexible capabilities of the electronic information and educational environment serve to implement the principle of individualization and adaptability. Adaptive learning platforms take into account each student's level of preparation, interests, and academic needs, resulting in an individual learning trajectory.

The principle of practical orientation ensures the application of theoretical knowledge in solving real mathematical and pedagogical problems. The inextricable connection of research results with practice is an important factor in the development of professional competence of future teachers. The preparation of future mathematics teachers for scientific and research activities has a complex integrative structure and consists of interrelated motivational-value, cognitive, operational-activity and reflective-evaluation components. The motivational-value component reflects the student's internal need for scientific research, the desire for professional growth, interest in innovative activities and commitment to scientific values. This component plays an important role in the formation of stable motives for scientific activity. The cognitive component includes a set of theoretical knowledge about the electronic information and educational environment, scientific research methodology, mathematical modeling methods, statistical analysis methods and modern digital tools. This knowledge creates a theoretical foundation for solving scientific problems on a scientific basis. The operational-activity component includes practical skills such as identifying a scientific problem, developing a research plan, collecting and processing data, performing mathematical analysis, and formalizing results in the form of a scientific article, thesis, or presentation. The technological capabilities of the electronic information and educational environment create favorable conditions for the effective development of this component. The reflective-evaluation component represents the student's ability to critically analyze his or her scientific activity, evaluate results, identify existing shortcomings, and determine strategies for

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improving further scientific activity. This component is an important factor in continuous professional development and increasing the effectiveness of scientific activity.

Conclusion

The electronic information and educational environment has great potential as a modern pedagogical tool for preparing future mathematics teachers for scientific research. However, this potential will yield effective results only if it is organized on the basis of a coherent pedagogical system - a set of clear principles, structural components, and conditions.

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